Fungi in the Diet of Domestic Sheep

Jerry T. Warren and Ivar Mysterud

Knowledge of the botanical composition of herbivore diet is important in the long-term management of forage resources. Various techniques have been developed to describe the diet of grazing animals. Each technique has limitations with respect to practicality, cost, and accuracy (Holechek et al. 1982).

In studies where food habits are registered by directly observing the foraging animal, fungi have been found to be seasonally important in the diets of sheep, goats, and reindeer (Garmo et al. 1990), as well as cattle (Bjugstad and Dalrymple 1968) and white-tailed deer (Odocoileus virginianus) (Miller and Halls 1969).

While summer grazing on an open coniferous forest range was being studied, the use of fungi was frequently observed, and several species appeared to be relished. Though a relatively minor component quantitatively, fungi may during a limited period be more important than realized.

Summer Grazing Study

In June 1985, eight ewes were each fitted with a motion sensing radio collar and tracked throughout the summer on a forest range in southeastern Norway (Fig. 1). Analysis of the tracking data showed that sheep frequented all of the study area’s habitat types. It was found that overall habitat use was not in proportion to habitat availability. Habitat preference also varied as the grazing season progressed. Use of the meadow/old field habitat type declined in favor of the forest types as the season progressed. Snow retreats first from open sites, thus allowing the growing season to commence several days (or even weeks) earlier in the open areas than in denser forest stands. As forage plants in the openings mature, their fiber content increases and nutritional value declines. Many of the same preferred forage species are found on the forested sites, but at an earlier stage of development. In order to locate preferred forage plants and maximize nutrient intake, sheep followed a phenological gradient, from open sites early in the season, into the denser forest as the season progressed. (Warren and Mysterud 1991).

Fungi Use and Nutritional Value

It was not only the richer forest types that were increasingly utilized. Use of the pine/heather/lichen forest type was also observed. Since the other understory plants in this type are of little nutritional value to sheep, the attraction to such areas was possibly related to the distribution and development of fungi. The use of fungi by livestock is apparently common in the boreal forest.

Overturned and partially eaten fungi were frequently found in all forest types. Sheep were observed eating fungi several times throughout late summer.
Fig. 1. Location of study area in southeastern Norway and distribution of radio-cesium fallout in Norway after the Chernobyl accident (After Norges offentlig utredninger 1986).
Studies conducted in 1986–89 have also registered use of fungi by free-ranging sheep (Warren and Mysterud unpublished). This was of little surprise to the farmers in the region. In past generations, when nearly all farm animals ranged freely, much effort went into limiting the extensive ranging of fungi-seeking livestock. Lambs are even known to wander away from the ewe to locate fungi (Eivind Skasberg pers. comm.).

Fungi are high in protein and phosphorus (Syrjälä-Qvist 1986). Their appearance and subsequent use coincide with the decline in nutritional value of the grasses and forbs. It is possible therefore that fungi contribute significantly to the animals’ diet. There may also be an important synergic effect when ingested together with the more quantitatively important, but increasingly decaying forage plants. Crawford (1982), citing other work, noted that fungi yield high proportions of volatile fatty acids which can increase plant digestibility. While studying white-tail deer, he found the autumn diet of dead leaves and fungi to be more digestible than both spring and summer diets of forbs, browse, and leaves.

Variable Fungi Crop and Range Use

Annual fungi crop can be highly variable. Mycelia lie seemingly inactive until the proper conditions arise, at which time fungi fruit can suddenly become abundant. This may cause sheep to frequent areas previously unused, and in some cases considered unimportant (Warren and Mysterud unpublished). Interestingly, areas which otherwise have few forage plants and are generally viewed as poor sheep range can contain an abundance of fungi fruit. Animals can range extensively in search of highly preferred, spatially variable fungi (Bjugstad and Dalrymple 1968). If, however, fungi are locally abundant, previously unpalatable forage may be utilized if in fact this forage becomes more digestible when eaten in combination with the fungi. This could lead to less extensive ranging despite declining forage quality. On the coniferous forest range in Norway the former appears to occur (Warren and Mysterud unpublished).

Cesium Accumulation

The physiology of fungi facilitates concentration of radio-isotopes in their fruiting bodies (Gulden 1990). Fallout from the Chernobyl accident in the Soviet Union in 1986 contaminated many grazing areas in Norway (Fig. 1). High cesium levels in sheep, reindeer, and goat and cow’s milk have been linked directly to the ingestion of fungi on contaminated summer ranges (Hove et al. 1990). Cesium levels may be 150 times higher in fungi than in the surrounding vegetation (Bakken and Olsen 1989). Carcass cesium levels can therefore vary greatly depending upon where animals have grazed. Animals on poorer ranges generally have higher levels of cesium. This is believed to be due to the greater relative proportion of fungi in the diet, as well as higher overall radio-cesium levels in plants on poorer sites (Varskog et al. 1989).

Since the Chernobyl accident, carcass cesium levels have varied directly with the abundance of fungi, and thus to a great extent with precipitation and temperature. In drier years, when fungi are relatively scarce, cesium levels are correspondingly low. In wetter years, rainfall and cooler temperatures lead to abundant fungi, and
cesium levels increase. Thus, seemingly promising declines in carcass cesium levels one year can be followed by a year with sharply increased levels. (Garmo et al. 1989).

Learning and Toxicity
Many fungi are toxic to both humans and livestock. Several of the more than 60 toxic species found in the Nordic countries (e.g., Amanita spp., Cortinarius spp.) are seasonally abundant in the coniferous forest in Norway. While no systematic record of the species consumed was made, examples of sheep at least "tasting" species poisonous to humans were observed. However, very few incidents of fungi poisoning in livestock are found in the literature (Overås et al. 1979). It is interesting to note that fly mushrooms (Amanita muscaria), which can cause death in domestic animals (Cooper and Johnson 1984) were almost always left untouched. Sheep must in some way learn which species are edible and which are to be avoided. Knowledge as to which fungus can be eaten offers potentially high nutritional benefits. The cost of ignorance is in many cases also high. At the same time, fungi's variability must complicate the learning process, especially in lambs, which accompany the ewe during only one, short grazing season. A closer look into this learning process, and into the use of fungi by livestock in general may improve our knowledge of livestock range use.

Literature Cited

Nominations by Petition Are Due December 1, 1991

This is a formal notice and request by the Nominating Committee for petitions nominating prospective candidates for the elected offices of Second Vice President and Director. Each section is encouraged to submit petitions. The following requirements apply:
(a) Each petition shall name only one candidate for any elected office
(b) Persons nominated must be eligible to hold the elective office for which they are nominated.
(c) A biographical sketch of the prospective candidate must accompany each petition
(d) Each petition shall bear the signature of at least 50 voting members of the society
(e) Petitions shall be submitted to the Chairman of the Nominating Committee not later than December 1, 1991.

The biographical sketch must include but is not limited to:
(a) Full name of prospective candidate
(b) Date and place of birth
(c) Educational background
(d) Current and previous occupation and employment
(e) Society activities in other organizations
(f) Past and present assignments and activities which demonstrate leadership ability

The Nominating Committee solicits your help in this important task of identifying the future leaders of our Society.

Please submit nominations to Raymond D. Mapston, Chairman, Box 507, St. George, Utah 84770 by December 1st.